

NAEB ENGINEERING
COMMITTEE
REPORT # 6

NAEB
TAPE RECORDING

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APRIL, 1954

NATIONAL ASSOCIATION OF
EDUCATIONAL BROADCASTERS
14 GREGORY HALL; URBANA, ILLINOIS

(Engineering Committee Report Number 6)

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Though the audio quality of programs supplied by the NAEB Network has in general improved considerably as the network service has developed, further advance is still possible in many cases. In an effort to assist in this advance, the NAEB Engineering Committee has investigated the situation and submits the following report and suggestions.

NAEB TAPE RECORDING

There have been isolated cases where, in the interests of presenting outstanding program material, master recordings of inferior audio quality were used because they were the only copies available. Very few such programs were used, however, and the practice is being discouraged. The major source of trouble seems to be in the improper adjustment of machines used for recording, duplicating and playback. Each is equally important. It is quite possible for the network to supply a perfect tape to a member station and have it produce poor audio quality while at the same time a tape recorded on that station's machine will reproduce satisfactorily. The only way that satisfactory operation will be insured is to make sure that machines used to produce the original recording, the tape duplicator, and each machine used for reproduction are adjusted for optimum conditions. It is the purpose of this paper to suggest how such adjustments may be made.

In the interest of brevity certain assumptions will be made. If these assumptions are incorrect and more information is desired, it will be supplied by the NAEB Engineering Committee. First, it will be assumed that member stations are equipped with high quality standard tape recorders which are capable of adjustment as outlined. There have been certain inexpensive units sold which were never capable of high quality reproduction, whose mechanical construction is such as to introduce irregular tape transportation, and whose recording or reproducing heads may not be adjusted. Second, it is assumed that full track heads are used for recording, duplicating and playback. Also that the tape is fully erased before recording. It is suggested that before recording the master or duplicates, each tape is erased

with a separate magnetic eraser. This will usually result in lower background and will insure against incomplete erasure by the recording machine. Third, it is assumed that each station engineer is familiar with the operation of his equipment, with the fundamentals of tape recording and with standard procedures for determining frequency characteristics, distortion, etc.

TAPE TRANSPORT - MECHANICAL

Irregular operation of the tape transport mechanism is usually responsible for "wows", changes in pitch, and timing errors. This is an individual problem and a faulty master cannot be corrected by any manipulation of duplicator or playback. It is suggested that a maintenance schedule be followed which will check the mechanism for speed variations. If any occur in the slightest degree, steps should be taken to make proper mechanical adjustments or replace defective parts. No attempt will be made here to suggest causes or adjustments as each type of recorder employs a different mechanical system and should be treated as a separate case. Engineers should be quite familiar with their units and any corrective work is usually a simple mechanical operation. If it is impossible to correct a mechanical fault with local facilities, it is suggested that the unit be returned to the factory for overhaul.

AMPLIFIER CHARACTERISTICS - ELECTRICAL

In checking frequency characteristics or distortion in the amplifier, standard procedures should be followed. It must be remembered, however, that these amplifiers are equalized to produce a characteristic

which is other than flat. Manufacturers data should be followed in checking these characteristic curves. Often failure to erase or insufficient erasure is encountered. This usually is traced to improper oscillator operation and in most cases is a result of defective tubes. Manufacturers data should be followed in checking bias and erase current as well as frequency. Normally there is little change in equalizer characteristics from the factory setting. Poor frequency characteristics, in most cases, may be traced to worn or dirty heads or improper head adjustment. This important feature is often overlooked and is one of the major causes of poor audio quality. It is actually the purpose of this paper to point out this one defect as it is thought to be the major problem contributing to poor NAEB Tape Network quality.

RECORDING AND PLAYBACK HEAD MAINTENANCE AND ADJUSTMENT

Before attempting to align the recording or playback heads it is wise to clean them, inspect them for wear, and make sure the tape is passing over the face of the head in the proper manner.

Heads become dirty from material picked up from the tape and a schedule of cleaning should be followed after every few hours of operation. Cleaning is easily and quickly done. A small cloth may be moistened with a solvent such as carbon tetra-chloride and used to remove dirt from the face of the head. A dry cloth will then remove any residue. Care should be taken to use only a small amount of the solvent and to be sure it does not run into other parts of the mechanism. Some solvents may dissolve the finish of the parts if care is not exercised.

After cleaning, the tape should be inspected as it passes over the face of the heads, the idler pulleys, and through the drive rollers. If the tape is pinched on one edge or its transport affected in any way so as to cause "skewing", adjustments should be made. If the tape is "skewed" as it passes over the head it will invariably result in poor recording or reproduction.

Next, inspect the heads with a microscope for foreign deposits, nicks, and wear. Foreign deposits can usually be removed with a solvent. If the surface of the head shows evidence of being nicked or worn, it should be returned to the manufacturer for replacement. Particular care should be given to an inspection of the gap for evidences of "break through". The edges of the gap are sometimes very thin and even moderate wear may cause them to break down. The result is an uneven gap edge. Heads showing evidence of such "break through" should be replaced.

The next step is to align the heads and for this purpose an alignment tape is necessary. The importance of this step is emphasized. If stations do not have a good alignment tape one may be secured from NAEB Headquarters at no cost. This alignment tape contains a recorded signal which will reproduce as 7500 cycles per second at a tape speed of 7.5 inches per second or 15000 cycles per second at a tape speed of 15 inches per second. The signal is recorded vertically on the tape to a tolerance of $1\frac{1}{2}$ minutes of arc.

First, if the tape machine is not equipped with an output volume level indicator such an instrument should be secured and connected to the output so as to indicate playback output level. The tape is threaded and controls set to produce a convenient reading on the volume level indicator.

Next, the head position is adjusted. However, before this is done it should be pointed out that the engineer must be thoroughly familiar with the manner in which the head is mounted and the methods of adjusting its position. Each manufacturer uses a different method of mounting so it will be impossible to describe all the various types and adjustments. A close inspection will usually make this clear. For machines that have a combination playback and recording head, play the alignment tape and adjust the azimuth alignment, or head position, until the output volume level indicator shows a maximum output. In making this adjustment be sure you are able to "run through" the maximum output, returning to the maximum for the final setting.

For machines having separate record and playback heads, first align the playback head from the tape as described above. Next, replace the alignment tape with a reel of your own stock tape. Connect an audio oscillator to the input of the recorder and record a signal from the oscillator of the same frequency as that on the alignment tape. As this recording is being made by the recording head (and being reproduced by the playback head and indicated on the output volume level meter) adjust the position of the recording head for maximum output from the playback head. (Playback head has already been adjusted for optimum position).

Another method of adjusting the recording head, (when the machine has separate recording and playback heads) is to connect the recording head in the place of the playback head and proceed with the alignment as you would in adjusting the playback head alone. This eliminates the use of the audio oscillator as described above but due to the necessity of getting inside the machine and changing soldered connections, usually

takes more time and is more complicated. Be careful to avoid any use which might stretch the alignment tape. After running forward in alignment procedure, reverse spools and run tape onto stock spool rather than rewinding.

The foregoing is not a difficult operation and should be done as a regular maintenance procedure. It is thought that correct alignment of heads and constant tape speed will eliminate the major cause of poor audio quality observed on NAEB Tape Network recordings. However, this will not be obtained unless the machine used to record the master, the duplicator at NAEB Headquarters, and each playback machine is correctly adjusted. Remember, with a misaligned head it is quite possible to make a recording which will sound excellent if played back on that same machine. However, if it is played back on another machine, poor audio quality will result.

If the procedures indicated above are carefully observed it is thought that the major causes of poor audio quality in tape network programs will be eliminated. However, it is obvious that complete cooperation of everyone is essential. Otherwise we may expect to have continued trouble.

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A collaboration among the Maryland Institute for Technology in the Humanities,
University of Wisconsin-Madison Department of Communication Arts,
and Wisconsin Historical Society.

Supported by a Humanities Collections and Reference Resources grant from
the National Endowment for the Humanities



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